Pion production cross-sections from E910 and MARS

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on
Neutrino Beams and Instrumentation

Fermi National Accelerator Laboratory

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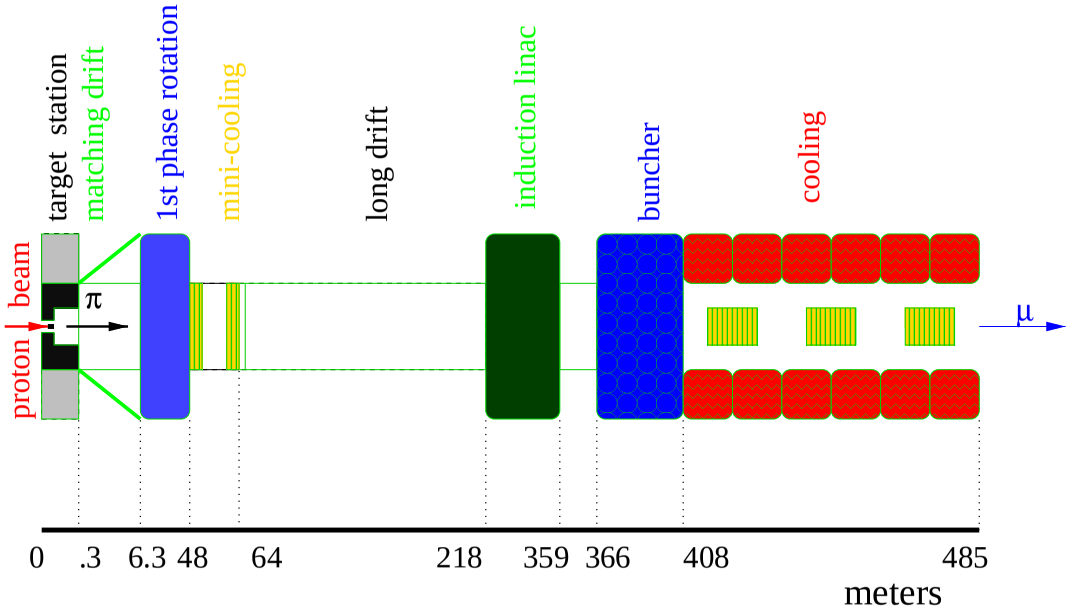
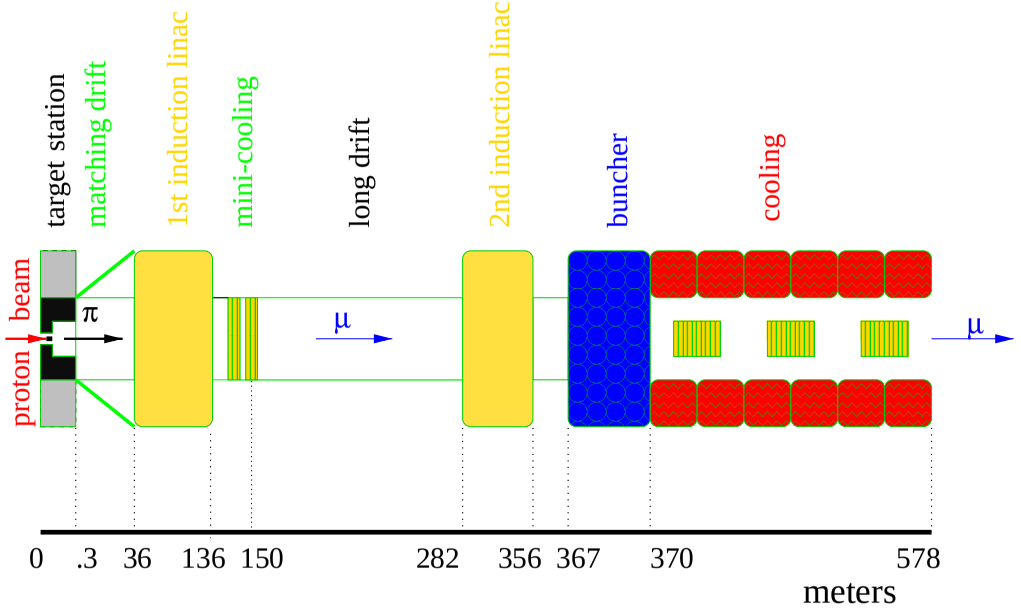
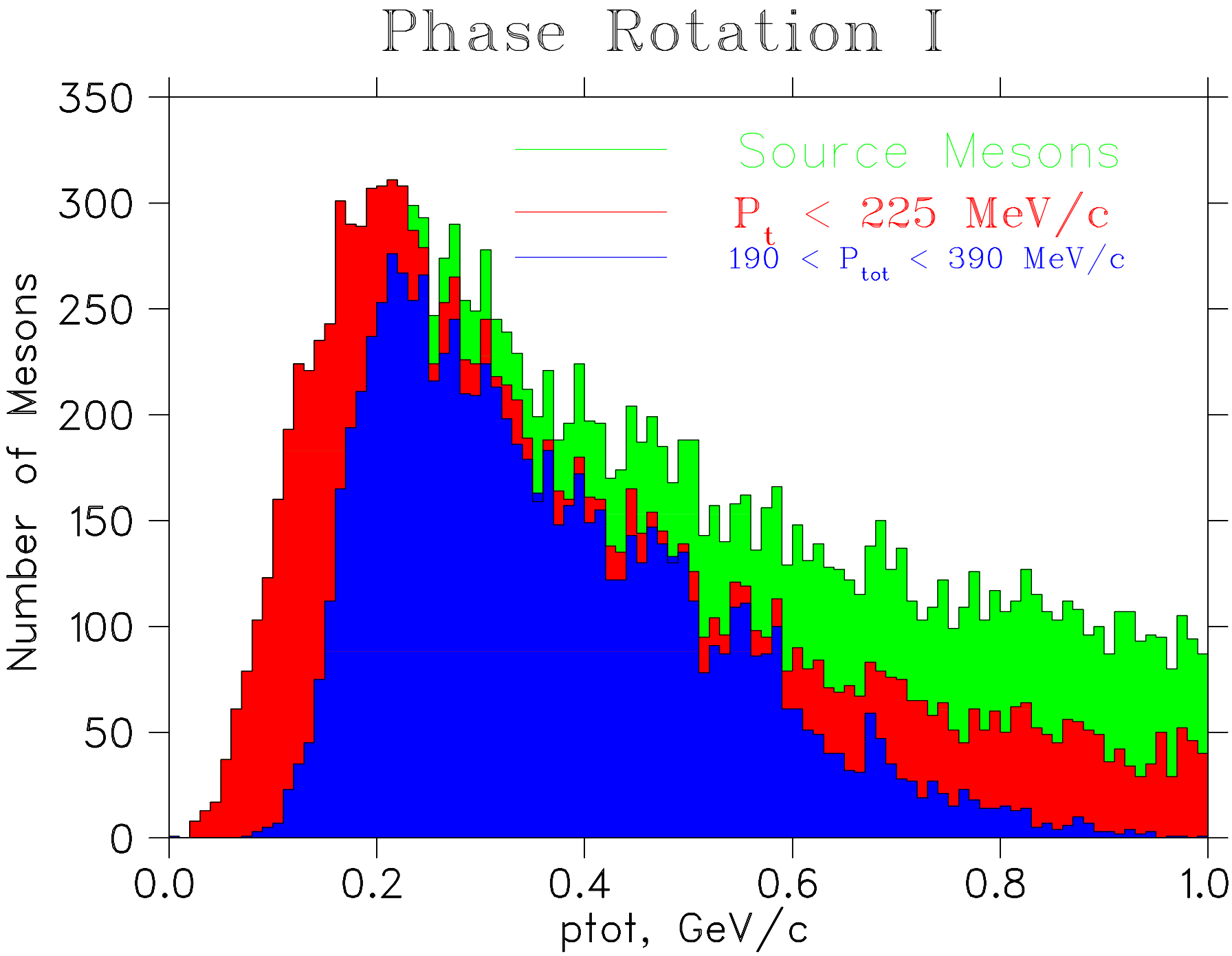
The Neutrino Factory Front-end

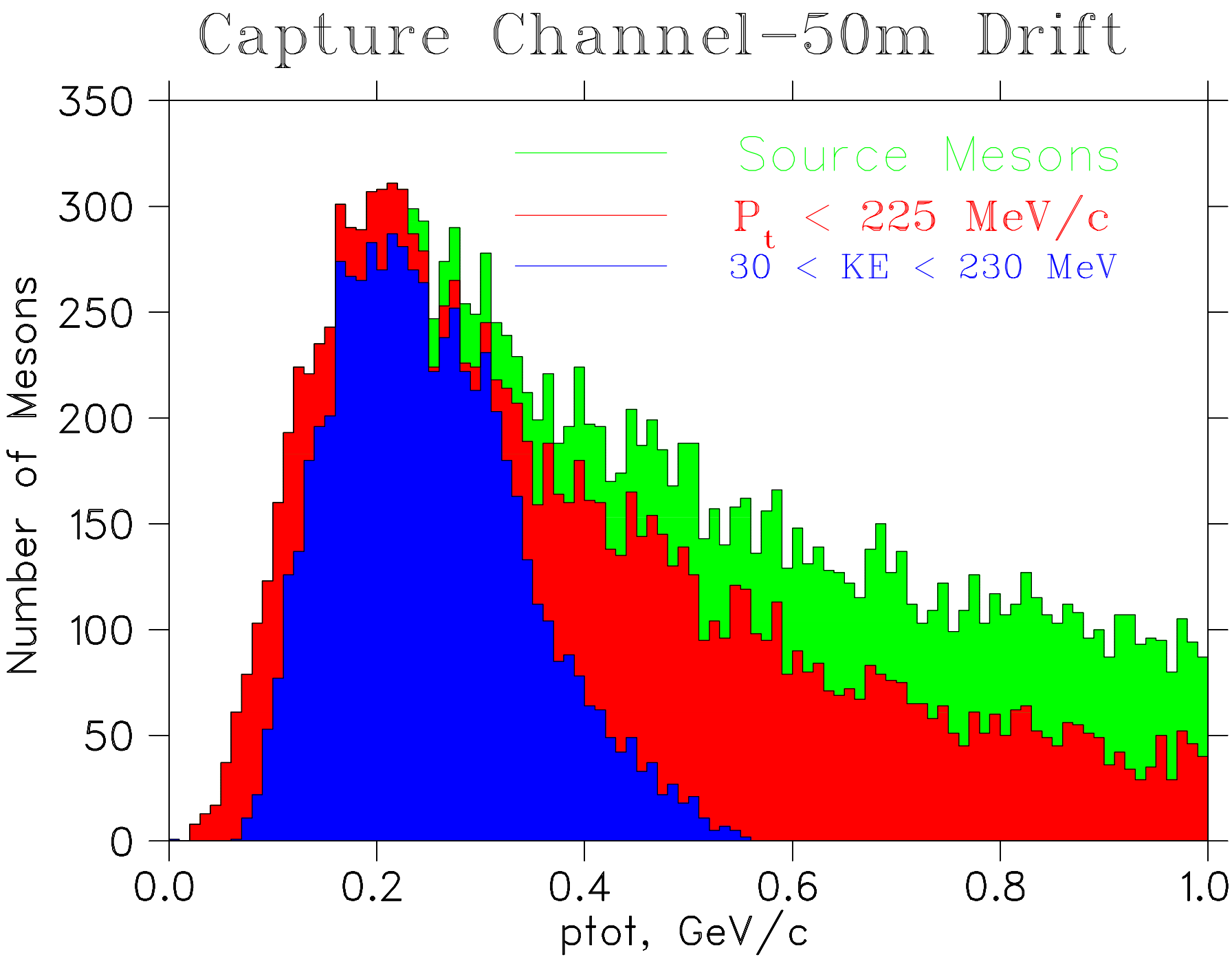
Scheme A



Scheme B

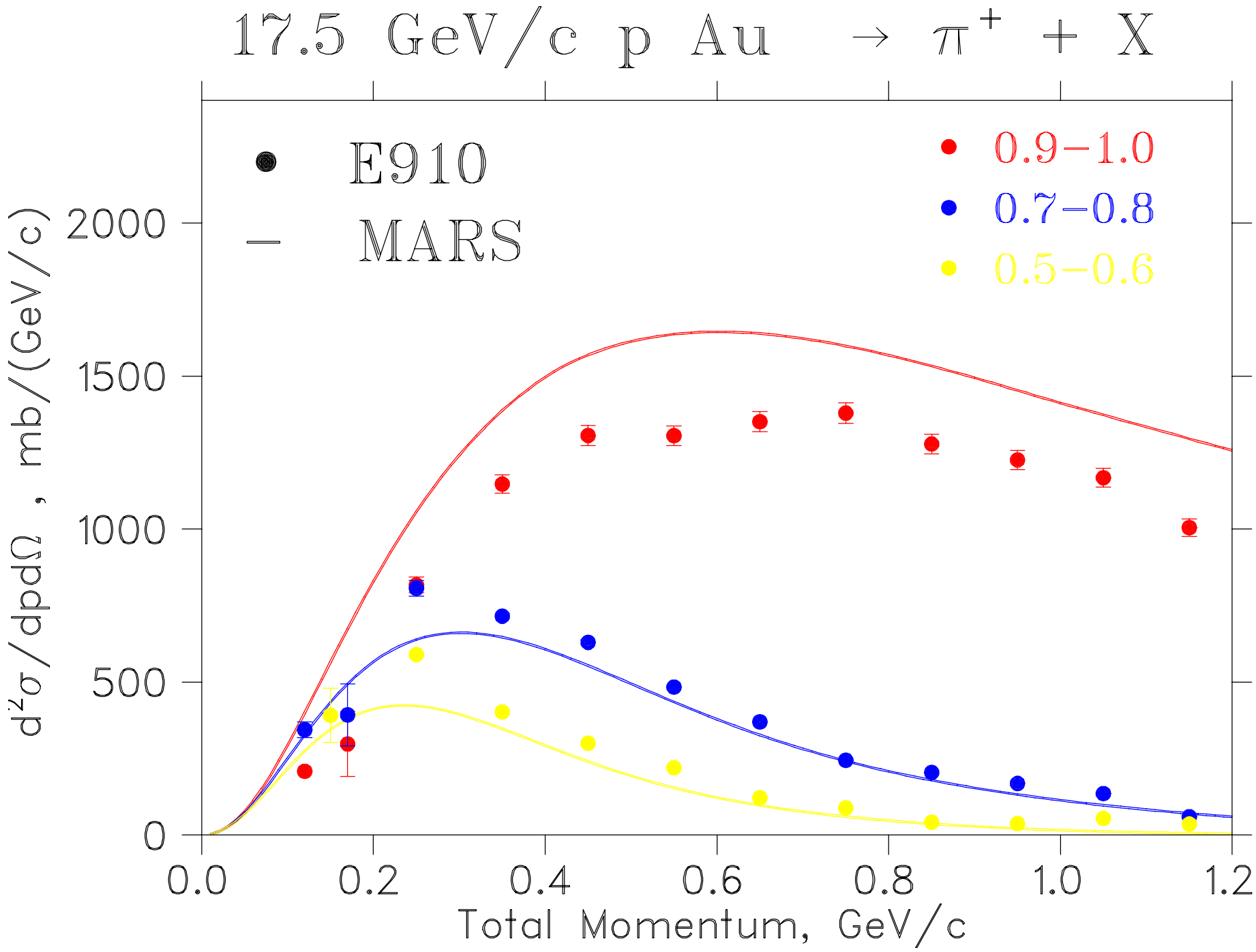


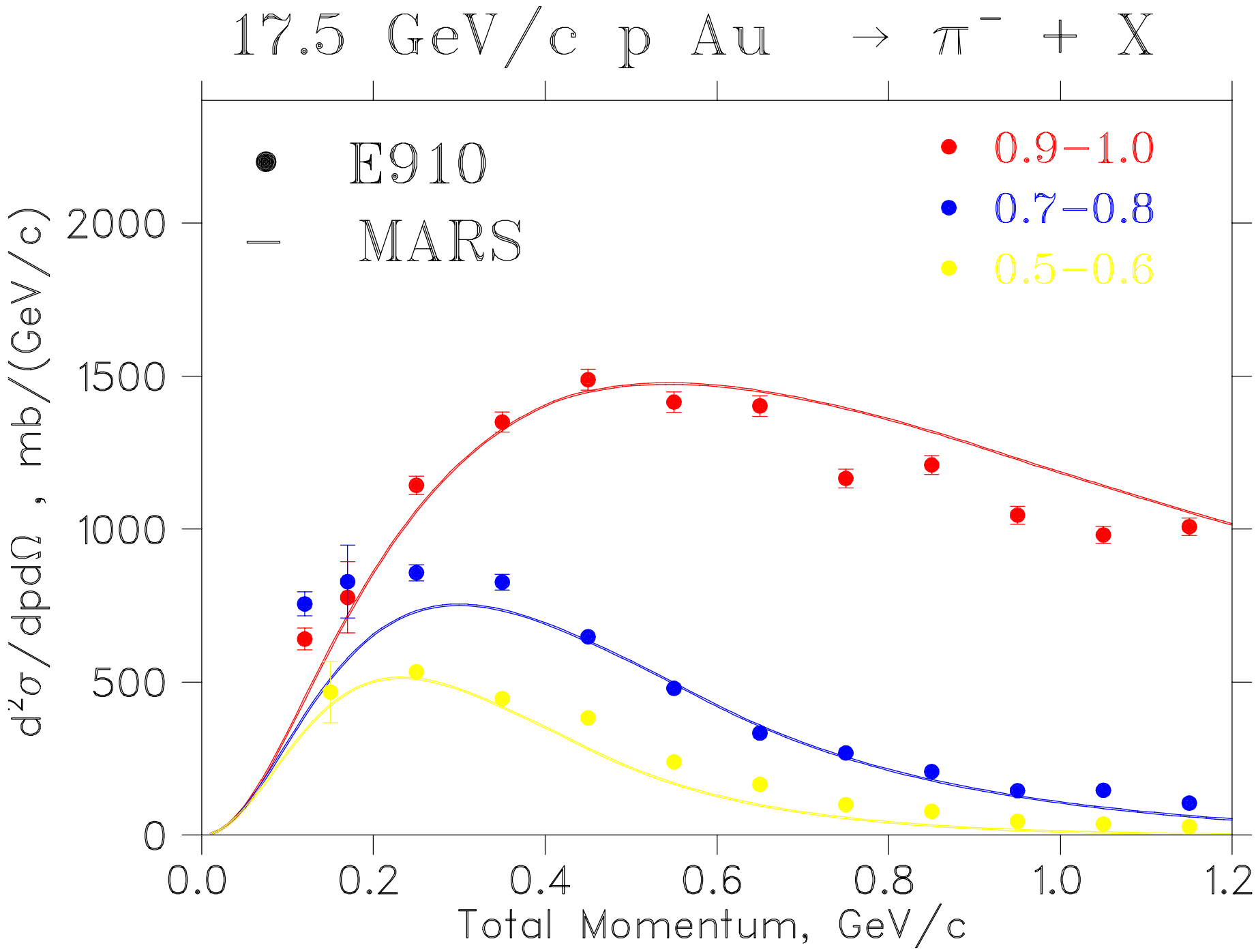

Phase Rotation I
Source Mesons
P_t < 225 MeV/c
190 < P_tot < 390 MeV/c
Number of Mesons
ptot, GeV/c
0
50
100
150
200
250
300
350
0.0
0.2
0.4
0.6
0.8
1.0

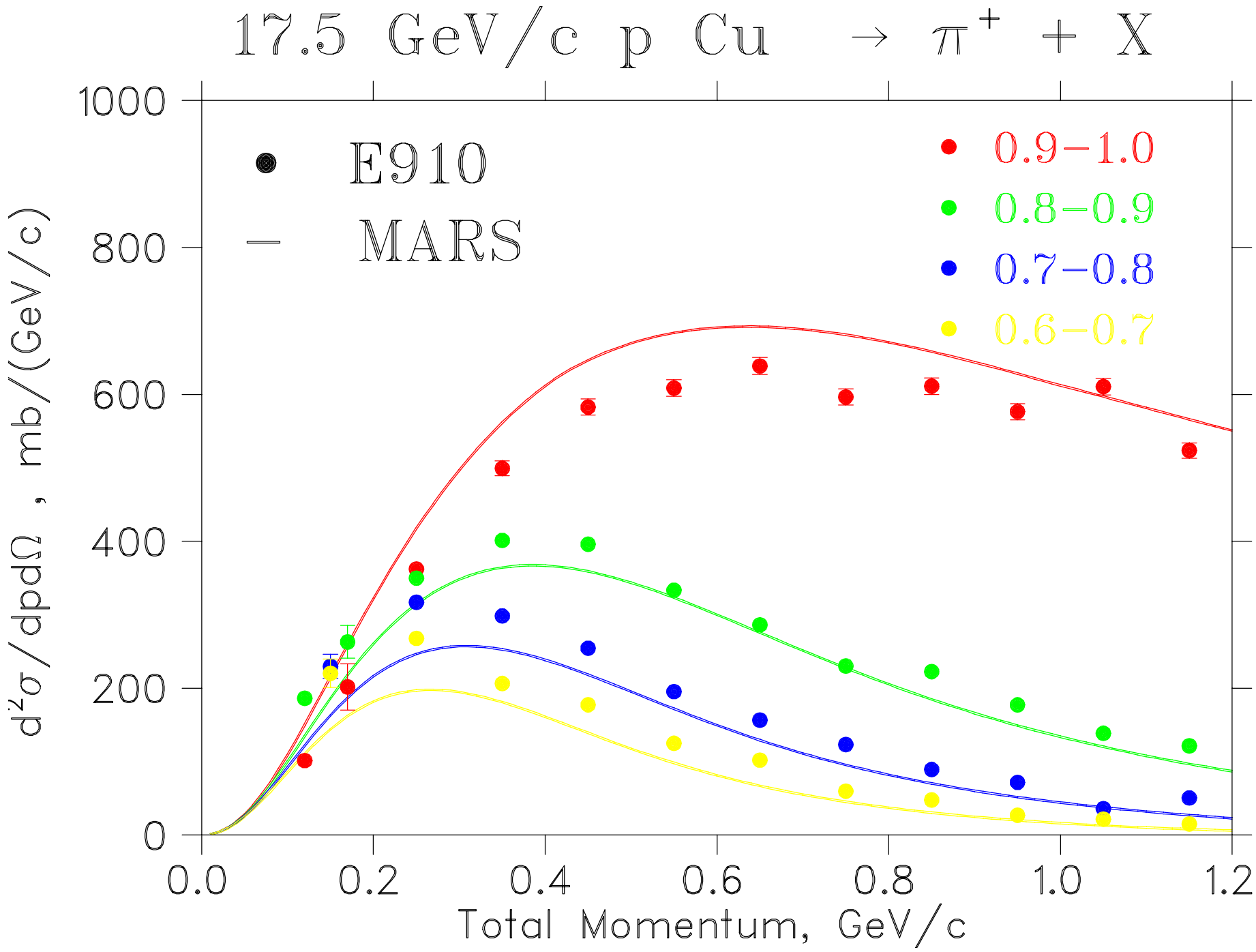

Capture Channel–50m Drift
Source Mesons
P_t < 225 MeV/c
30 < KE < 230 MeV
Number of Mesons
ptot, GeV/c
0
50
100
150
200
250
300
350
0.0
0.2
0.4
0.6
0.8
1.0

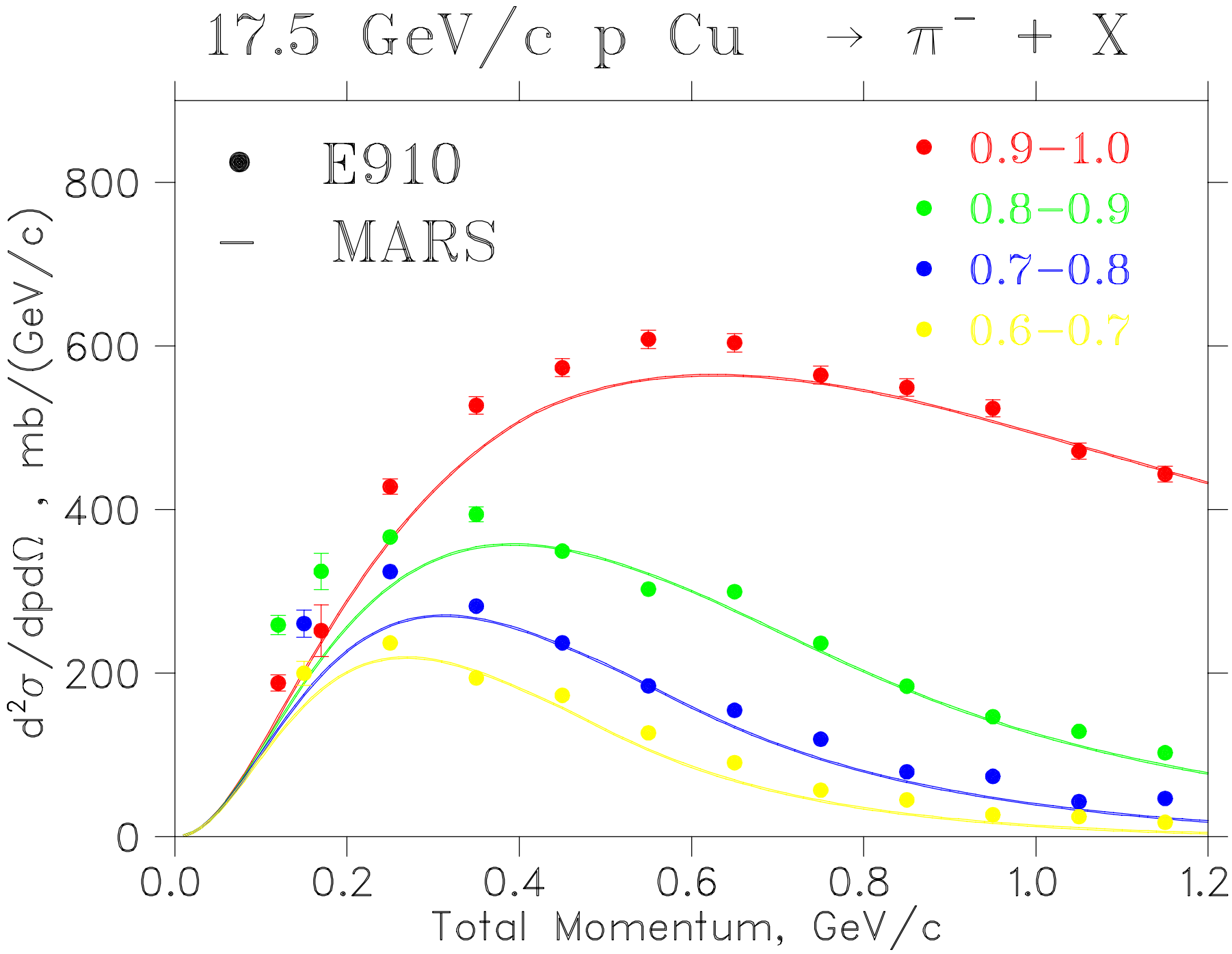
The Neutrino Factory Targets

- High Z option: 24 GeV protons on Mercury
- Low Z option: 16 GeV protons on Carbon

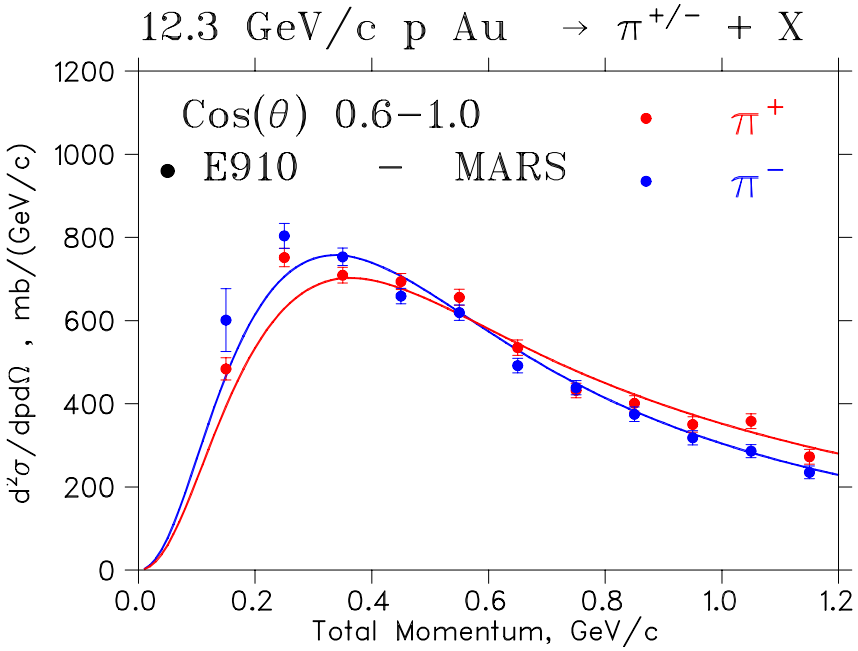

17.5 GeV/c p Au → π+ + X
E910
MARS
0.9–1.0
0.7–0.8
0.5–0.6
d²σ/dpdΩ , mb/(GeV/c)
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Total Momentum, GeV/c

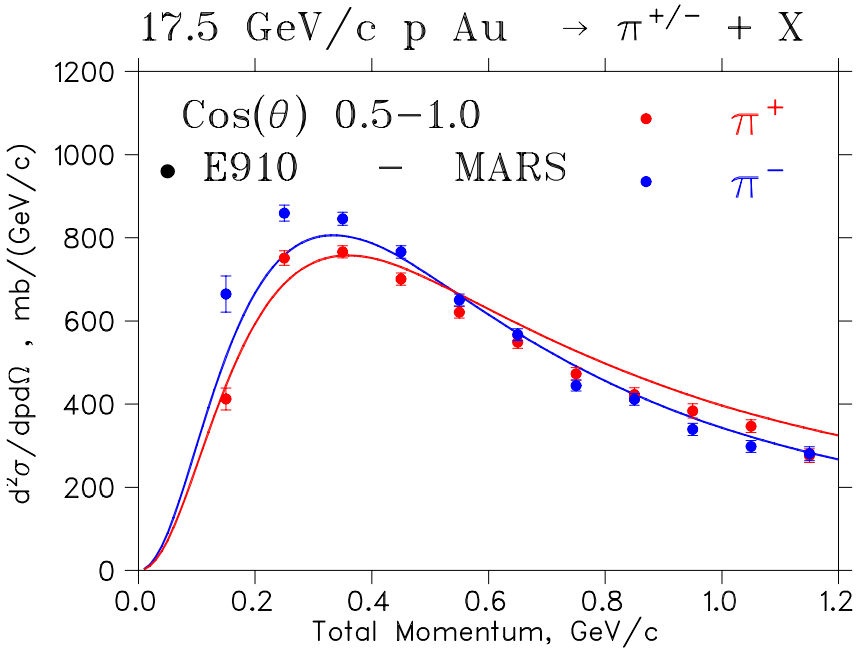

17.5 GeV/c p Au → π⁻ + X
E910
MARS
0.9–1.0
0.7–0.8
0.5–0.6
d²σ/dpdΩ , mb/(GeV/c)
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Total Momentum, GeV/c


17.5 GeV/c p Cu → π+ + X
E910
MARS
0.9–1.0
0.8–0.9
0.7–0.8
0.6–0.7
d²σ/dpdΩ , mb/(GeV/c)
Total Momentum, GeV/c
0
200
400
600
800
1000
0.0
0.2
0.4
0.6
0.8
1.0
1.2

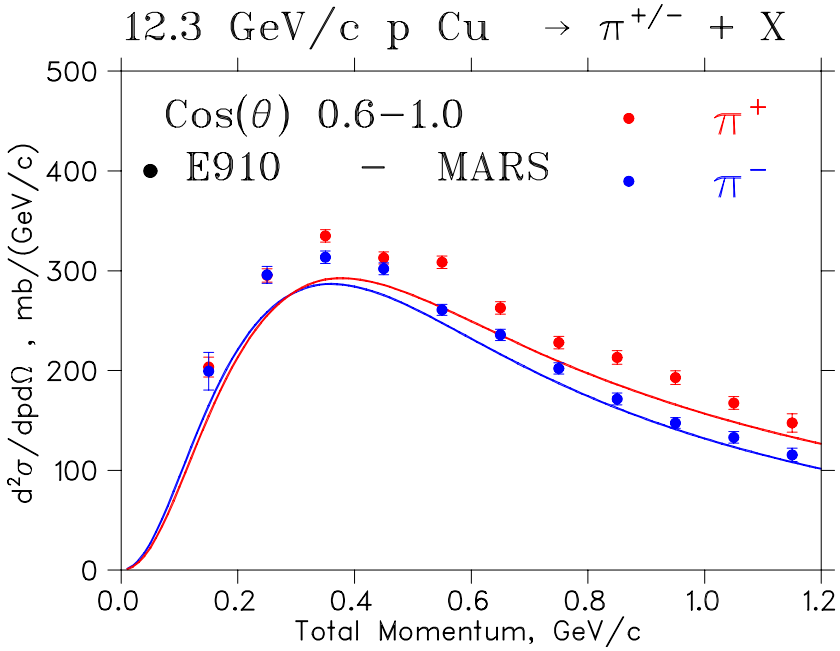

17.5 GeV/c p Cu → π⁻ + X
E910
MARS
0.9–1.0
0.8–0.9
0.7–0.8
0.6–0.7
d²σ/dpdΩ , mb/(GeV/c)
0
200
400
600
800
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Total Momentum, GeV/c

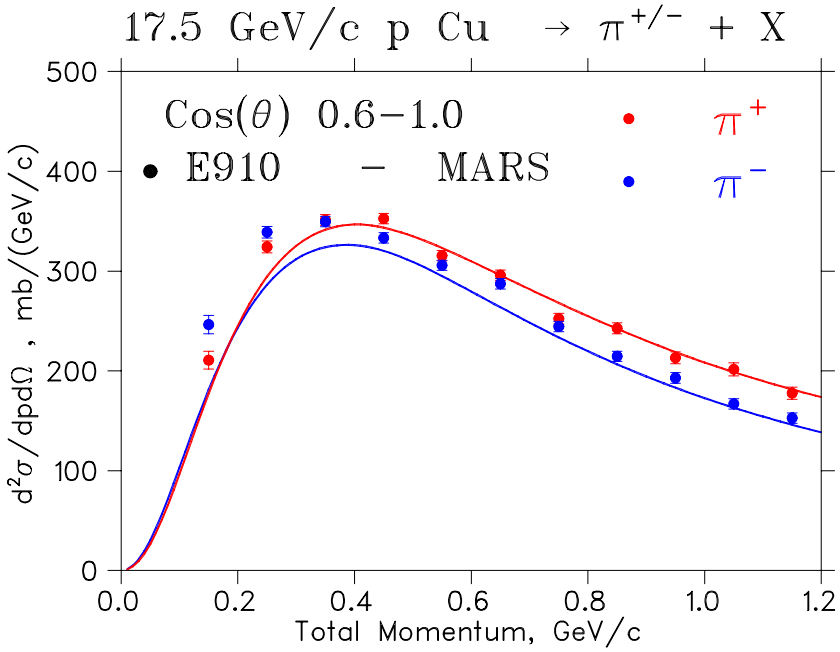
proton Au Interactions



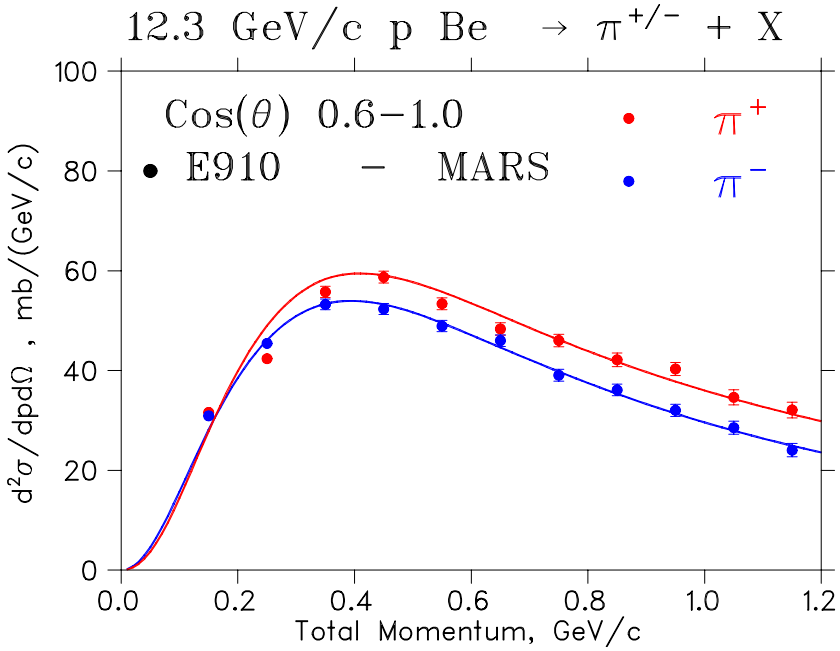


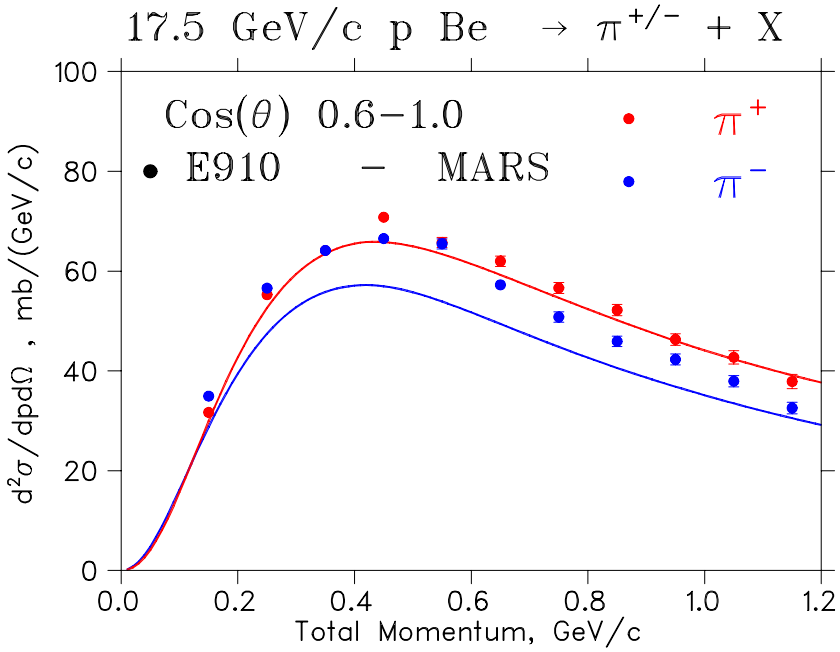
proton Cu Interactions



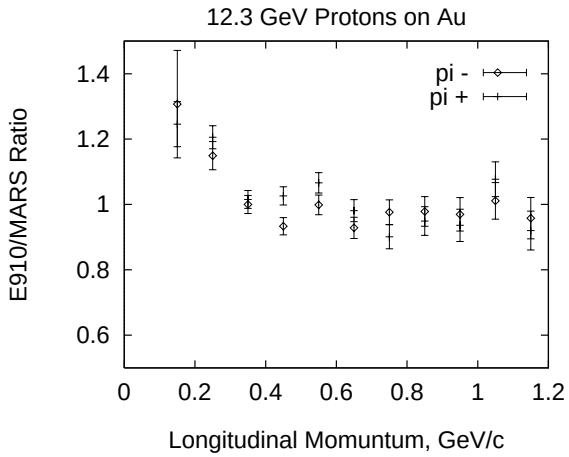


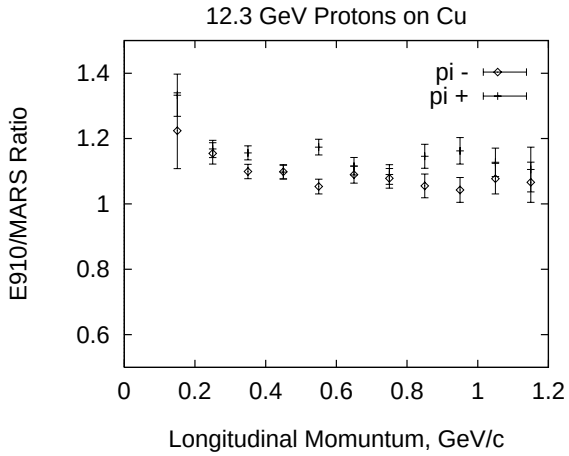
proton Be Interactions

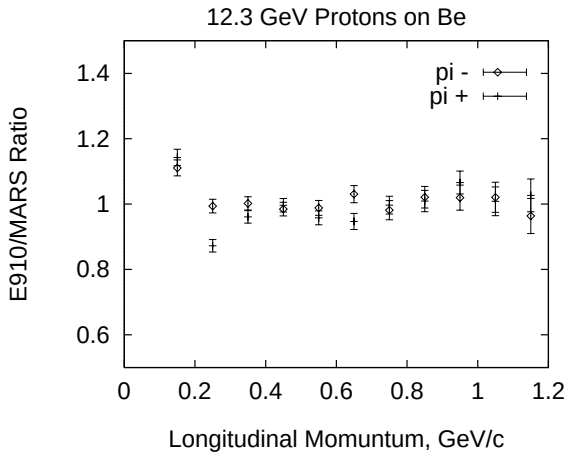




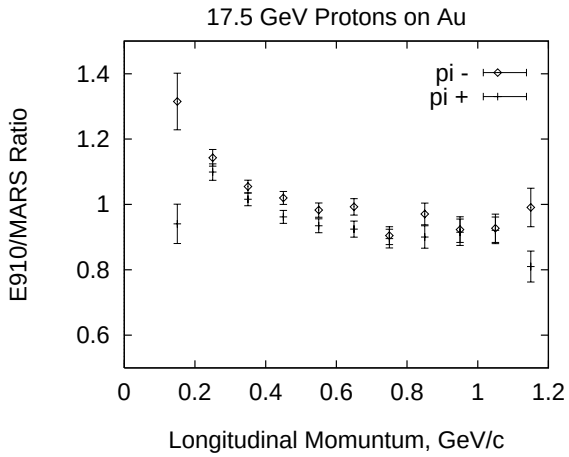
E910 Compared with MARS at 12.3 GeV/c

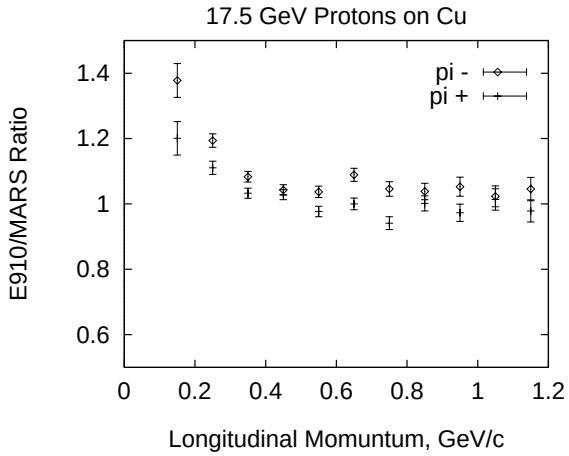


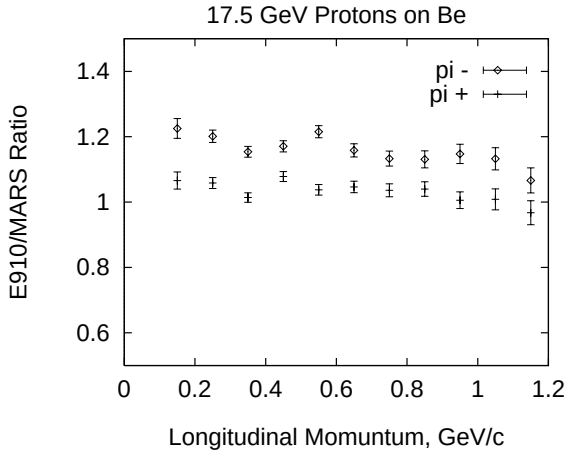




E910 Compared with MARS at 17.5 GeV/c







Summary

For incident 12-18 GeV proton-nucleus interations

- In general, agreement with E910 and MARS is quite good.
- For pions produced from 0.5 to 1.0 GeV/c, pion production agrees to within 10%.
- For soft pions (p $<$ 200 MeV/c), E910 has $\approx$ 20% more pions than MARS predicts.